U.S. EPA's Office of Research and Development (ORD)

Region 3 State Directors' Meeting

August 24, 2017

Richard Yamada, Deputy Assistant Administrator for Research & Development

Bruce Rodan, Associate Director for Science

Research & Development Mission

Provide the science, technical support, technology, and tools to inform EPA's mission to protect public health and the environment.
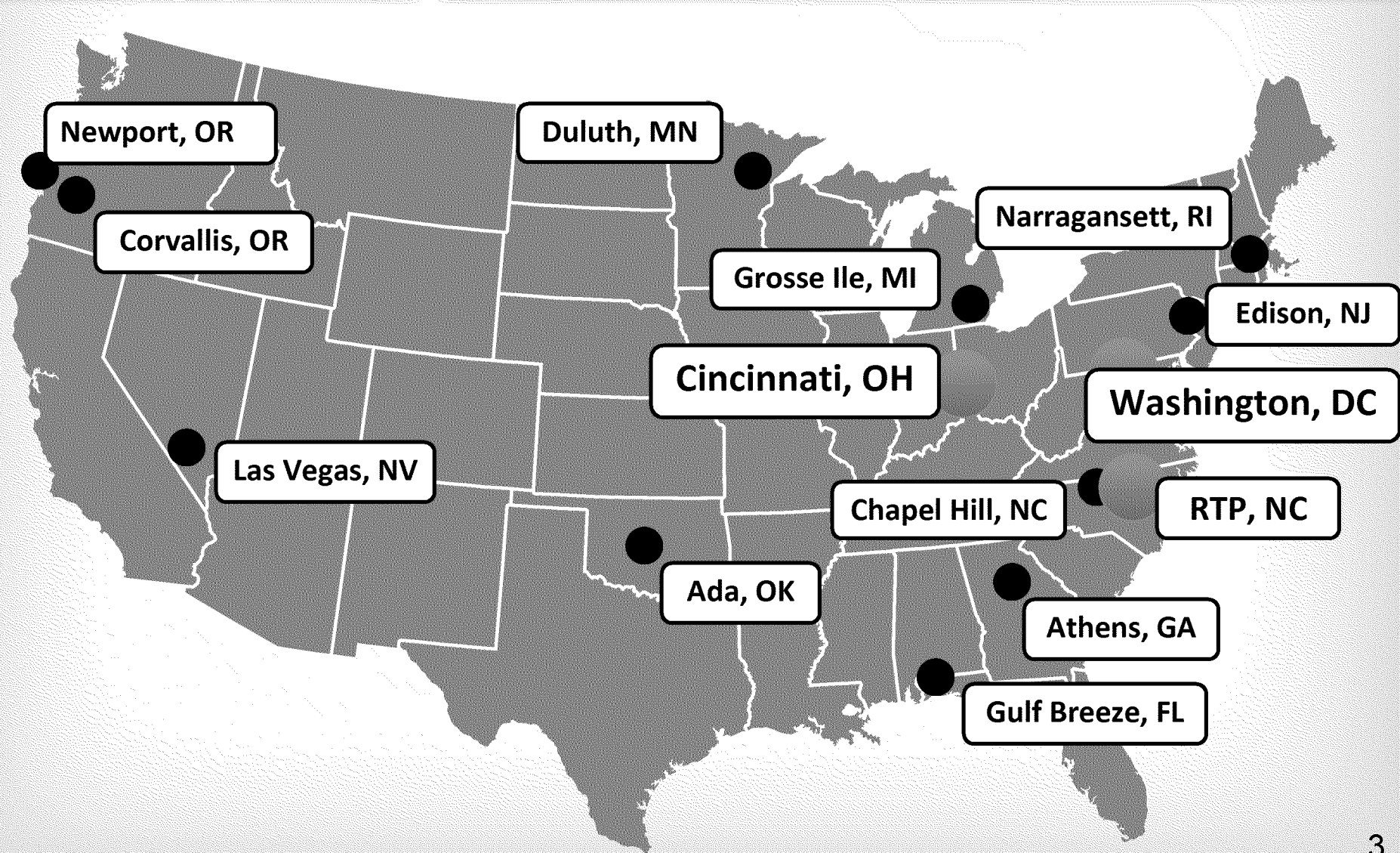
EPA-ORD Research Triangle Park   EPA-ORD Cincinnati ...

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ORD provides the scientific foundation for EPA to execute its mandate to protect human health and the environment.

1. **Longer Term Research:** ORD conducts innovative and anticipatory research applied to a range of EPA program and regional needs in air, water, land, and homeland security to solve longer term major environmental challenges and provide the basis of future environmental protection.

2. **Research on Specific Environmental Challenges:** ORD experts provide research support to EPA program and regional offices, as well as states, tribes, and communities, to help them respond to contemporary environmental challenges.

3. **Technical and Emergency Support:** Because of our expertise, local, state, and national officials come to us for technical support to respond to environmental crises and needs, large and small.
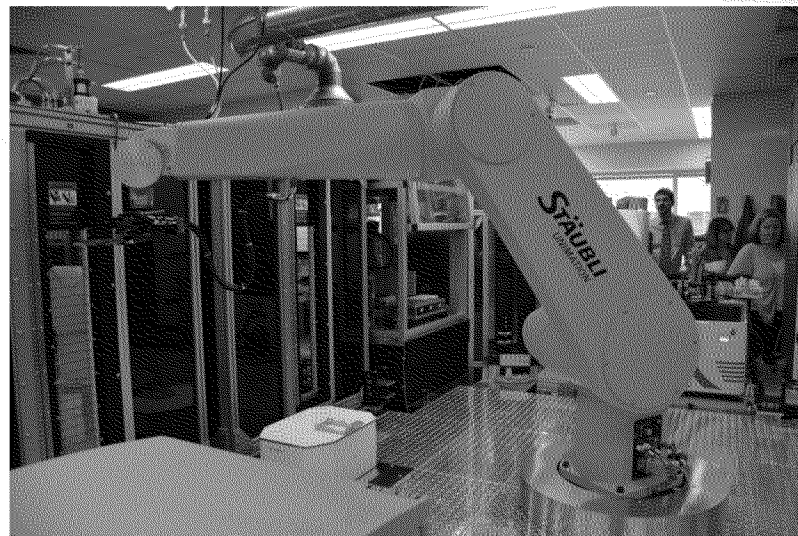
1. Longer Term Research

Chemical & Exposure Science

EPA's Computational Toxicology research applies cutting-edge technologies to efficiently and economically evaluate the safety of thousands of chemicals currently in use.

Advances in chemical research include:

- **Rapid testing for chemical exposures** combined with EPA's toxicity data to prioritize chemicals based on their potential to cause health risks

- **Alternatives to animal-testing** that are faster and less expensive, aligning with new TSCA standards

- **Publicly available data and tools** for use by states, companies, and the scientific community

- **Tox21 partnership** with NIEHS, NIH, and FDA

- **Endorsed by recent NAS Report**, "Incorporating 21st Century Science in Risk-Based Evaluations"

- **Global interest** in applying new methodologies to accelerate the pace of chemical risk assessment
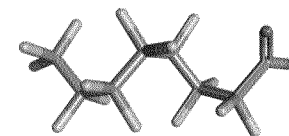
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- **ORD's Homeland Security Research Program** focuses on protecting water systems security, and remediating wide-area contamination incidents.

- **Addresses chemical, radiological, and biological** threats in a post-9-11 world.

- **Advances in decontamination research include:**

  - Anthrax decontamination technologies in partnership with the Department of Homeland Security.

  - Real-world decontamination techniques to measure the costs and effectiveness of each method, and the expense of managing waste from cleanup.

  - Transportation system recovery, determining the best ways to bring a transportation system, like a subway, back to service following an event as part of the Underground Restoration Project where we worked with the Department of Homeland Security, and the Department of Defense.

2. Research on Specific Environmental Challenges

- More than 1,000 different PFAS in the TSCA inventory and some are used in everyday products, including stain resistant materials, non-stick cookware, and firefighting foam.

- PFAS contamination in soil and water: Hoosick Falls, NY; Joint Base Elmendorf Richardson in Anchorage, AK; and Wurtsmith Air Force Base in Michigan.

- **ORD researchers are studying PFAS:**

  - Hazards, including through our computational toxicology research
  - Exposure and laboratory methods, developing robust analytical methods for ground, surface, and wastewater and for solids including soils, sediments, and biosolids
  - Remediation options, developing a standardized method for remediation of PFAS in groundwater, ambient water, soil, and sediment

- Cross-Agency Coordination Team for PFAS led out of Office of Science Advisor (OSA)
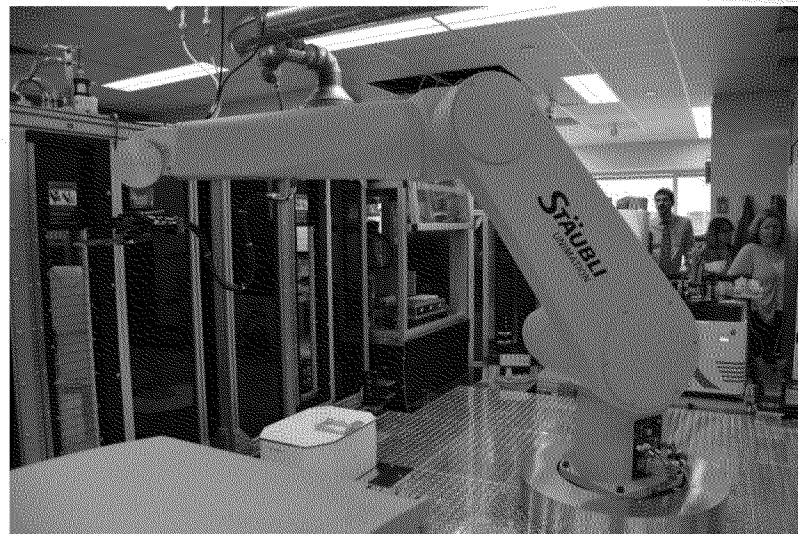
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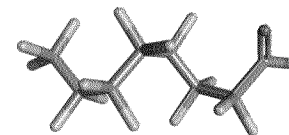
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- **Toxicology studies** to compare wildland and urban smoke effects

- **Health communication** information

- **Smoke Sense App** development

- **Wildland Fire Sensors Challenge**

  Learn more at https://www.challenge.gov/challenge/wildland-fire-sensors-challenge/

- **Improved emissions and air quality modeling of wild and prescribed fire**, such as the Flint Hills field work and model development
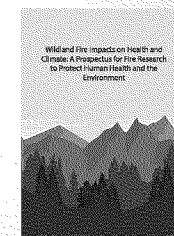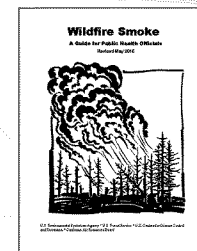
3. Technical and Emergency Support
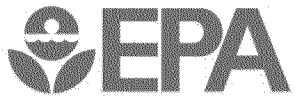
- In August 2014, Ohio EPA and the City of Toledo requested ORD's technical assistance to analyze drinking water for the presence of cyanobacterial toxins resulting in a harmful algal bloom.

- ORD helped identify the best approach for controlling cyanobacterial toxins in the treatment plant and the distribution system.

- Scientists provided rapid, crucial scientific assistance to inform the "Do Not Drink" order that the City of Toledo issued for approximately 500,000 people.

- We then provided critical information to the Mayor of Toledo and the Governor of Ohio to help them make the decision to lift the "Do Not Drink" order.


"When we were faced with an emergency in Toledo due to cyanobacterial toxins detected in their treated drinking water, ORD staff was a great partner and exceeded our expectations in understanding science and helping optimize treatment and restore safe drinking water to our residents."
—Ohio EPA Director Craig Butler

- **ReAChback for Emergency Response**
  - Quick-response scientific support capability to ensure coordinated, timely response to large-scale disasters
- **Corpus Christi, Texas Drinking Water Contamination**
  - Identified decontamination approaches to purge the drinking water systems of the contaminant
- **Flint, Michigan Drinking Water Crisis**
  - Developed sampling protocols and exposure risk assessment models for lead in drinking water, and distribution system monitoring for disinfectant and disinfection byproducts
- **Ebola Response**
  - Prepared for Ebola patients in U.S. by identifying decontamination methods for Personal Protective Equipment for health care workers, technical support for waste management, and the fate of the virus in wastewater
- **Gold King Mine**
  - Provided toxicity information and developed modeling for long-term monitoring
- **Elevating Critical Public Health Issues Policy**
  - Developed a process to allow staff to expedite the elevation of important issues
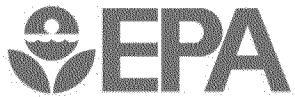
- ORD has Technical Support Centers that respond to requests from EPA's program offices and regions at Superfund, Resource Conservation & Recovery Act (RCRA), and Brownfields sites.

- For example, historical chemical manufacturing operations at a site in Riegelwood, North Carolina, have resulted in contaminated groundwater, surface water, soil, sediment, and aquatic biota. ORD centers reviewed data collected from the site and made recommendations for additional testing to inform cleanup decisions.
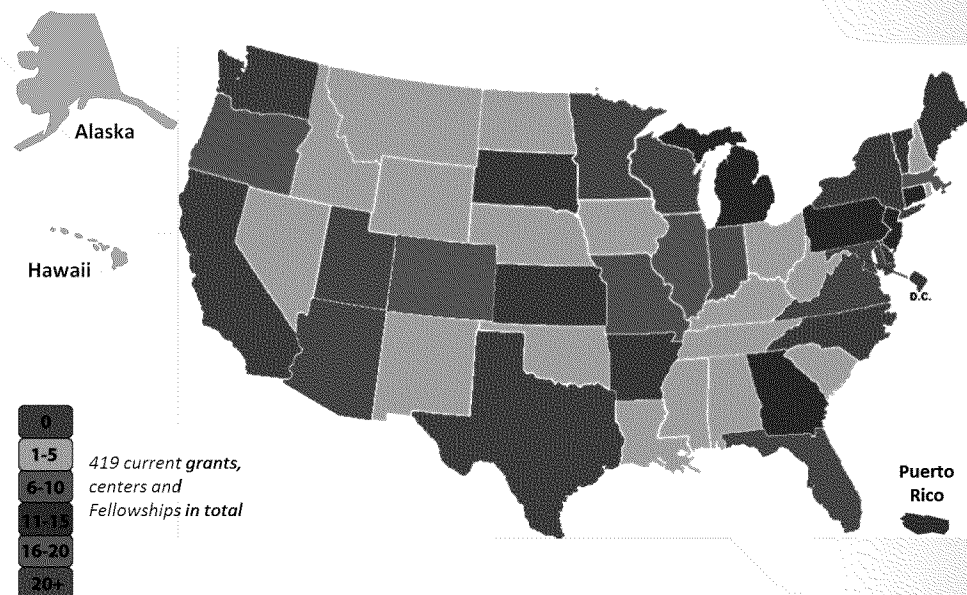

Technical Support Center Requests from FY16.
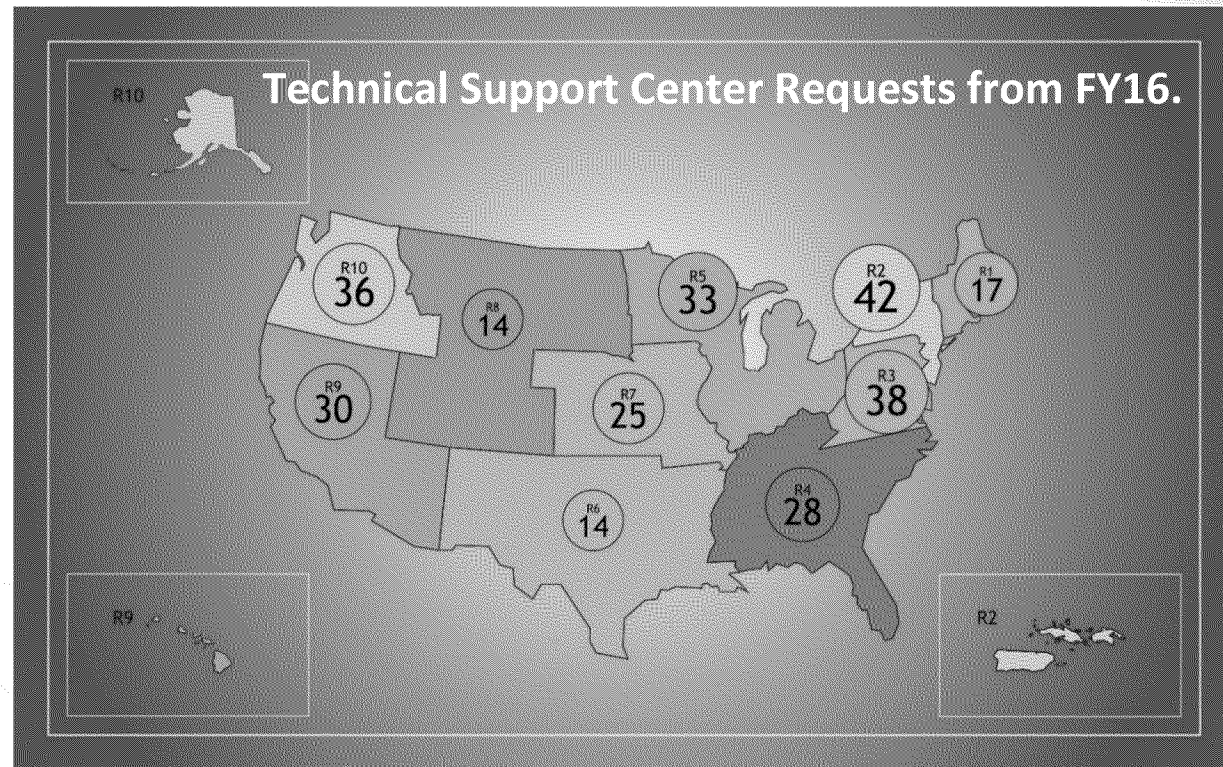
Science to Achieve Results (STAR)

- Funds research grants through a competitive selection process.

- Engages the nation's best scientists and engineers in research to complement EPA's own research.

- The map shows extramural research grants, centers, and Fellowships active in FY15.

Alaska

Hawaii

| 0 |
| 1-5 |
| 6-10 |
| 11-15 |
| 16-20 |
| 20+ |

419 current grants, centers and Fellowships in total

Puerto Rico

D.C.

Small Business Innovation Research (SBIR) Program

- Mandated by the Small Business Innovation Development Act of 1982

- Provides critical early-stage capital for innovative small companies in the green tech arena.

- Since 1982, EPA SBIR has supported 616 individual small businesses with 1,782 (1329 Phase Is, 453 Phase IIs) awards and around $186,000,000 in 46 states (as of 2016).
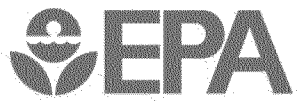
OSP's Regional Science Program links ORD with EPA's regional offices and promotes the integration of ORD science into regional and state decisions.

- Builds networks and partnerships between ORD and regional office staff
- Coordinates programs involving regionally-focused research that often includes a state or local partner and addresses high priority science needs
- Provides technical support to regions, states and communities
- Key components include:
  - Regional Applied Research Effort – responds to high priority, near-term applied research needs of EPA's regions, state and local governments, and tribes
  - Regional Research Partnership Program – A short-term training program that provides opportunities for regional scientists to work with ORD researchers
  - Regional-ORD Community of Science Networking Program – A networking program for regional scientists and engineers who have limited familiarity with ORD

ORD Research Planning

- Cooperative Federalism, legal mandates, public participation
- Topical Priorities:
  - Drinking water and clean water infrastructure
  - Contaminated sites restoration
  - Air quality standard attainment
  - TSCA reform implementation
  - Ensuring sound science and research
  - Detecting non-compliance and performing required Federal inspections
- Strategic Planning Framework in preparation

ORD Support to EPA Regions
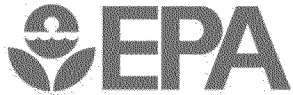
The Regional Science Program links ORD with EPA's Regional offices and promotes the integration of ORD science into regional and state decisions.

- <u>Networks and partnerships</u> between ORD and Regional office staff
- <u>State and local engagement</u> in regionally-focused research to address priority science needs
- <u>Technical support</u> to regions, states and communities
- Key components of the Regional program include:
  - <u>Regional Applied Research Effort</u> – high priority, near-term applied research needs of EPA's Regions, state and local governments, and tribes
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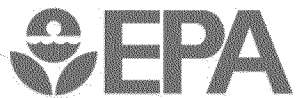
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State agencies work on the front lines of protecting public health and the environment

- # State Research Needs
  - Through ECOS/ERIS surveys
  - Through Regional Office

- # Memorandum of Agreement with ECOS and the Association of State and Territorial Health Officials (ASTHO)
  - Two ORD pilots on Wildfire Smoke Guide and C-FERST
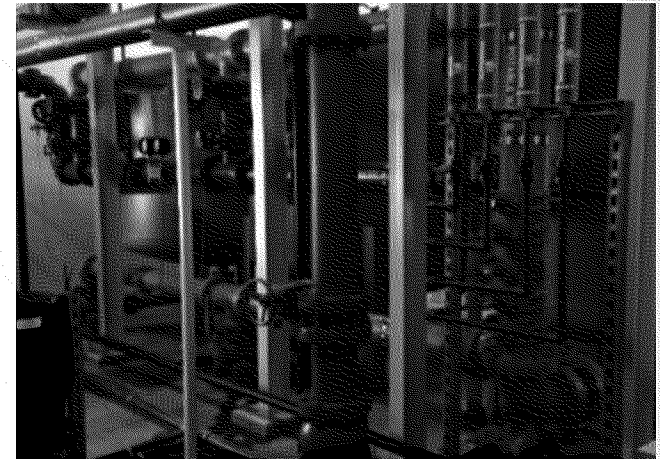
"Ammonia residual in the distribution system can cause nitrification and other operational 'nightmares.' This EPA ORD supported pilot project in Palo is successful and the use of biologically active filters is an innovative, emerging drinking water technology that can be a viable option for certain other systems." — Bill Ehm, Director, Environmental Services Division, Iowa Dept of Natural

- *EPA Tools & Resources* monthly webinars
  - Highlights ORD Research including:
    - National Stormwater Calculator
    - Green Infrastructure Modeling Toolkit
  - Archived past webinar recordings and presentations available at:
    https://www.epa.gov/research/epa-tools-and-resources-webinar-series

- Outreach and collaboration
  - Lab visits to share ORD scientific capabilities and discuss research topics of interest to states
  - Exchange program with state scientists

- **Water Quality**
  - Nutrients
  - Stormwater
  - Water reuse
  - Wastewater infrastructure
  - Small system drinking water and wastewater treatment
- **Emerging Contaminants/Toxics**
  - Manage new chemicals of emerging concern and existing chemicals (e.g. PFAS)
- **Waste/Remediation**
  - Soil
  - Groundwater
  - Surface water
  - Sediment
- **Air**

  - New ozone standard
  - Interstate and cross-border transport
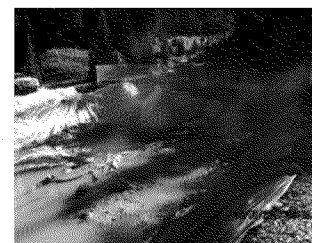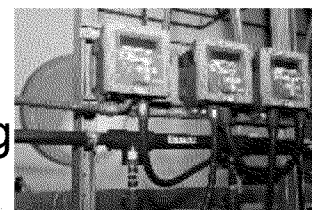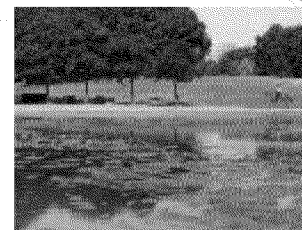
2016 ERIS States' Research Needs Survey Summary:
https://www.ecos.org/wp-content/uploads/2017/04/ERIS-Survey-Summary-One-Pager.pdf

Partners: Alliance for Chesapeake Bay, Chesapeake Bay Foundation, Dauphin County Conservation District, Lancaster County Clean Water Consortium, Lancaster County Conservancy, Lebanon County Conservation District, Pennsylvania State University and Susquehanna River Basin Commission

Challenge: Managing stormwater treatment systems to protect and to restore water quality in the Chesapeake Bay (ongoing)

Resource: Center for Green Infrastructure and Stormwater Management

- The EPA ORD-supported Center for Green Infrastructure and Stormwater Management conducts research to understand and influence how decisions are made at spatial and jurisdictional scales to manage stormwater treatment systems.

- The Center brings stakeholders and multi-discipline researchers together to improve stormwater management in urban and suburban settings; to reduce pollutant loads of nutrients, sediments, organics and metals; and to minimize stormwater volume and energy use across a range of storm event magnitudes.

- The Center identified cognitive and institutional barriers preventing communities from adopting green infrastructure measures to manage stormwater, designed green infrastructure and developed methods to help stakeholders visualize alternative infrastructures.

"An ounce of stormwater pollution prevention is worth a pound of cure, particularly when it adds multiple benefits through green infrastructure and natural treatment systems. The Center helps Chesapeake Bay states and stakeholders find solutions to some of our most challenging water quality problems through science-based innovation and collaboration."

– Maryland Department of the Environment Secretary Ben Grumbles

Partner: Maryland Department of Environment (MDE) and other state air agencies

Challenge: Need for effective strategies to reduce harmful air pollutants (ongoing)

Resource: EPA's Community Multiscale Air Quality (CMAQ) Modeling System

CMAQ predicted ozone for June 1, 2013

- EPA and states have used EPA's CMAQ Modeling System, a computational tool that simultaneously models multiple air pollutants, including ozone, particulate matter and a variety of air toxics for over 15 years.

- State agencies that control air pollution use CMAQ to assess actions needed to meet the National Ambient Air Quality Standards (NAAQS) mandated by the Clean Air Act.

- States use the tool to identify sources of air quality problems and design effective strategies to reduce harmful air pollutants. Using data about land use, meteorology and emissions, CMAQ provides information about the concentrations of air pollutants in a given area.

- CMAQ brings together 3 kinds of models including: meteorological models to represent atmospheric and weather activities; emission models to represent man-made and naturally-occurring contributions to the atmosphere; and an air chemistry-transport model to predict the atmospheric fate of air pollutants under
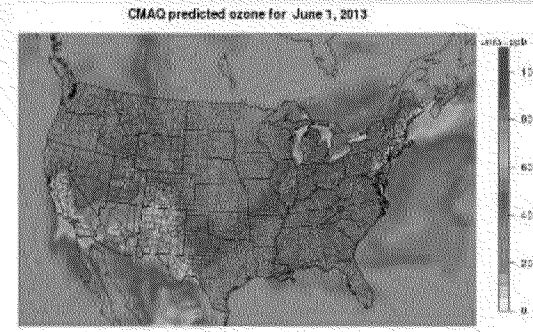
"Maryland has made dramatic progress over the past 10 years in reducing ozone and fine particle pollution. We have invested heavily into research and modeling and this investment has been one of the reasons we have been successful. The CMAQ photochemical model has been the key tool we have used to design and refine control strategies. It has helped us find least cost solutions to reduce ozone and fine particle pollution." – MDE Secretary Ben Grumbles

Partners: Maryland Department of Environment (MDE), California, Colorado, Connecticut, Kentucky, New Hampshire and Oregon

Challenge: Identifying appropriate opportunities to use advanced monitoring tools, new data collection and analysis techniques to create improvements and gain efficiencies in environmental monitoring (ongoing)

Resources: Development, pilot testing, and evaluation of advanced monitoring technologies

- New advanced monitoring technologies are available that are smaller, more portable and less expensive, but rapidly evolving monitoring technology presents challenges to characterize performance (i.e., accuracy, precision and reliability).

- EPA ORD is supporting E-Enterprise for the Environment joint efforts, including an options and feasibility analysis on creating an independent third-party evaluation/certification for new technologies, while continuing research on the use and performance of new monitoring technologies.

- An EPA-supported research center will deploy a large, distributed network of low-cost air quality monitors in Baltimore and will collect data to assess variability in pollutant concentrations, source contributions and exposures across the city.

"Our partnership with EPA on advanced monitoring is extremely important. With new sensors entering the market every day, understanding if they work and how to communicate the data they generate is a critical need for state environmental agencies. In 2017, two major sensor studies are taking place in Baltimore, where hundreds of stationary and mobile sensors will be collecting data on multiple air pollutants and greenhouse gases. This partnership with EPA is both critical and timely."
– MDE Secretary Ben Grumbles

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Partners: Maryland Department of Health and Mental Hygiene (DHMH), New York State Department of Environmental Conservation (NYSDEC)

Challenge: Management of biohazardous wastes associated with Anthrax and Ebola incidents (completed)

Resource: Technical assistance

- In response to the 2014 Ebola outbreak, EPA ORD scientists, in collaboration with Region 2 staff, provided technical support related to decontamination products and best ways to use them, as well as recommendations for best decontamination methods for Personal Protective Equipment, important to health care workers and others who came into contact with Ebola patients.

- EPA ORD gave instructions on how waste contaminated with the Ebola virus should be managed and information on the fate of the virus in wastewater.

- ORD participated in a workshop with Maryland DHMH and helped develop the National Security Council's Multiagency Interim Guidance on Management of Wastes containing Category A Infectious Agents, such as Ebola.

"During the 2001 and 2006 anthrax incidents in New York City and the 2014 Ebola crises, NY state reached out to EPA ORD and Region 2 staff for their experience and acumen to collaborate on creating a 'complete waste solution.' This involved designing training sessions, developing a computerized decision support tool (I-WASTE), a NYC Environmental Response and Remediation Plan for Biological Incidents, and conducting and publishing research on the ability of commercial autoclaves to treat thermally resistant anthrax spores and the triple packaging used for transport of highly infectious agents. Collaborative efforts by EPA and NYSDEC have contributed significantly in the management of biohazardous waste that has been timely and crucial to protecting public health and the environment in NY state and nationally."

– Dr. Alan Woodard, Research Scientist, NYSDEC Division of Materials Management

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Partners: Maryland Department of the Environment (MDE), Montgomery County, City of Rockville

Challenge: Identifying the most cost-effective suite of stormwater best management practices (BMPs) to meet both local sediment total maximum daily loads (TMDLs) and downstream targets for Chesapeake Bay TMDL (ongoing)

Resource: Case study application of EPA's Watershed Management Optimization Support Tool (WMOST) version 3

- MDE identified the Cabin John Creek watershed as impaired by sediments, nutrients, bacteria, chlorides, sulfates and impacts to biological communities. To help address these impairments, MDE is providing guidance to local communities about applying cost-effective best management practices (BMPs) to meet regulatory targets set by the total maximum daily loads (TMDLs) for sediments.

- EPA ORD is applying version 3 of WMOST to the Cabin John Creek watershed to determine the most cost-effective suite of stormwater BMPs (including green infrastructure) for controlling sediment loading.

- Watershed managers are using the results of WMOST calculations to identify solutions to meet both local sediment targets and downstream loading targets for total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN) for the entire Chesapeake Bay watershed.

"One of Maryland's greatest challenges, and opportunities, is to ensure its Phase I MS4's meet permit and TMDL restoration requirements in ways that are affordable and sustainable. This study, in a small urban watershed, is a cooperative effort among state, county and city governments and EPA to develop a balanced implementation strategy. EPA ORD's modeling tools used in this study have unique features such as stormwater BMP runoff reduction estimates and cost optimization modules to help us achieve environmental results, while maximizing savings for ratepayers."
– MDE Secretary Ben Grumbles

Partners: Pennsylvania Department of Environmental Protection (PA DEP)
Challenge: Wide-spread freshwater fish disease
Resource: Causal Analysis/Diagnosis Decision Information System (CADDIS)

- Since 2005, mortality and disease outbreaks were observed in Smallmouth Bass in the Susquehanna River Basin.

- In 2012, the PA DEP initiated a large study of the river. PA DEP and its partners looked to EPA ORD's expertise and innovative tool CADDIS to help organize and synthesize the data.

- EPA assisted PA DEP and its partners in implementing the CADDIS causal assessment process, providing a means to utilize the study data collected to date; winnow the long list of hypothesized causes of the Smallmouth Bass health issue; and optimize further data collection and analysis efforts.

"I am confident that our science-based partnership with EPA ORD and the Pennsylvania Fish and Boat Commission will help us determine the causes of impacts to aquatic health in the Susquehanna. Science guides our work in assessing the overall health of the river, and in partnership with these agencies, we will be able to create a strategy that matches our challenges to conserve and protect this river, which is important to the recreational vitality and economic prosperity of Pennsylvania." – John Quigley PA DEP (former Secretary)

Partners: Participating pilot locations including the cities of Chicago, IL; Durham, NC; Hartford, CT; Houston, TX; Kansas City, KS; Oklahoma City, OK; Philadelphia, PA and Washington, DC
Challenge: Air quality monitoring for community awareness (ongoing)
Resource: Village Green Project

- Original prototype was field-tested outside a public library in Durham, NC; currently there are 8 stations across the U.S., including stations in Independence National Historical Park in Philadelphia and at the Smithsonian's National Zoological Park in Washington, DC.

- Village Green Project (VGP), developed by ORD, is a compact, solar-powered system that takes air and weather measurements with instruments built into a park bench.

- VGP showcases next-generation air measurement technology by providing quality-assured data to the public on a near real-time basis, updating to a public data website every minute.

"The Village Green station is a helpful tool in educating the public, and particularly children, about the importance of air quality in our everyday lives. We are thankful to be one of several cities across the country to have such an innovative tool."
– Oklahoma DEQ Executive Director Scott Thompson *referring to the VGP in Oklahoma City*

Partners: Stafford County, VA; City of Baltimore, MD; York, PA
Challenge: Methods to address the effects of current and future changes in storm intensity, heavy precipitation events, and severe floods in stormwater management planning (completed)
Resource: Technical support to identify barriers and provide tools, data, methods and actions to facilitate planning for impacts of severe storms and floods in collaboration with the NOAA and their partners

- Changes in storms and heavy precipitation events, affects the volume of stormwater runoff that municipalities must manage to protect public health and water quality.

- EPA ORD scientists and NOAA held workshops and led other community-level efforts across states within the Chesapeake Bay and Great Lakes regions to jointly derive insights into how to disseminate weather and climate information to help communities increase the resiliency of stormwater systems, especially in the face of land use changes and more intense storms and floods.

- A summary report was prepared to inform states and communities on implementing stormwater management plans, including low-impact development practices that collect and absorb runoff from rooftops, sidewalks and streets, and other alternative management strategies.

"Effective planning requires a clear understanding of the science. To that end, the help we are receiving from EPA scientists is critical to enabling us to come up with short and long range plans that will protect our lands and our waterways."
– VA DEQ Director David Paylor

Partners: Virginia Department of Environmental Quality (VA DEQ)

Challenge: Integration of state and national stream condition assessments (completed)

Resource: Probabilistic survey designs integrating national and state reporting requirements

- VA DEQ is charged with reporting stream conditions, presenting a need to conduct sampling protocols that accurately represent stream water quality across the state's many streams without overwhelming state resources.

- EPA-developed strategy of probabilistic surveying has been incorporated into the National Aquatic Resources Surveys (NARS), which includes national-scale assessments of rivers and streams, lakes, coastal zones and wetlands.

- VA DEQ collaborated with EPA ORD to develop probabilistic survey designs specifically for their state stream condition assessments, and the resulting survey design ensures representativeness of sampling locations, using statistical tools to determine condition values and levels of uncertainty.

"Virginia DEQ has found it very helpful to integrate our state stream condition assessment into the National Streams and Rivers Assessment. With technical assistance from ORD, we were able to apply robust statistical analysis to calculate a picture of stream health for the entire state from a small, manageable set of field samples."

— VA DEQ Director David Paylor

Partners: DE DNREC, MD DNR, PA DEP, VA DEQ, WV DEP, Susquehanna River Basin Commission (SRBC) and other states
Challenge: Develop a baseline monitoring network to detect long-term trends (ongoing)
Resource: Technical support to states and tribes through workshops and stream monitoring network development, in collaboration with the U.S. Forest Service and the USGS

- EPA ORD and its partners are working to establish Regional Monitoring Networks (RMNs) for freshwater wadeable streams to collect long-term biological, thermal, hydrologic, physical habitat and water chemistry data to document baseline conditions across sites and detect long-term changes.

- RMN surveys build on existing state and tribal bioassessment efforts with annual sampling of a limited number of sites that can be pooled at a regional level.

- RMN data can be used for informing water quality and biological criteria development and protection planning priorities, refining lists of biological, thermal and hydrologic indicators, and detecting trends in commonly-used water quality and biological indicators.

"As an interstate agency, SRBC certainly recognizes the value of the regional partnership EPA has assembled to address the need for collecting the data necessary for detecting changes to water quality and aquatic life communities over time, especially as it relates to any regional trends that may result from climate change effects. The establishment of an effective regional network is a bigger task than any single agency can undertake given the resources involved, and EPA's staff provided the needed leadership to establish and guide the partnership, as well as the scientific expertise on the study methods for characterizing any future changing conditions."
– SRBC Executive Director
Andrew Dehoff